UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/782,778	02/23/2004	Jong Won Kim	K5675.0034/P034	5493

7590 12/29/2006

Thomas J. D'Amico
Dickstein, Shapiro, Morin & Oshinsky L.L.P.
2101 L Street NW
Washington, DC 20037-1526

EXAMINER	
RAYMOND, BRITTANY L	
ART UNIT	PAPER NUMBER
1756	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/29/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/782,778	KIM ET AL.	
	Examiner	Art Unit	
	Brittany Raymond	1756	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) 1-9 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-9 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on 2/23/2004 is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 5/10/2004.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claims 1-9 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

As to step E of claim 1, the phrase "filling up said space...with plating method" is indefinite because the word choice makes it unclear as to what is actually being claimed.

Regarding step I of claim 1, the phrase "forming a metal layers" makes it unclear as to whether one or multiple layers are being formed.

As to step J of claim 1, it is unclear if the portion of the seed layer on the bottom of the metal layer can be removed.

Claim 2 recites the limitation "the step of forming middle seed layer" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Regarding claim 5, the use of "large viscosity" is indefinite for failing to define the meaning of large.

Claim 7 recites the limitation "the boundary area" in line 3 and "the side plane of the pattern" in line 4. There is insufficient antecedent basis for this limitation in the claim.

As to claim 9, the phrase "different kinds of metals" is indefinite because it could mean that alloys could be used instead of metals. The phrase "different metals" is sufficient.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

4. Claims 1-3, 8, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin (U.S. Patent Application 2004/0166659) in view of Suzuki (U.S. Patent 6379871).

Lin discloses a process for making an integrated circuit structure comprising the steps of: depositing a seed layer material onto an adhesion layer which has been applied to a substrate, depositing a thick photoresist onto the seed layer, patterning the photoresist, electroplating a layer of metal onto the photoresist layer to fill the openings, and stripping the photoresist and portions of the seed metal and adhesion metal

(Paragraph 0053), as recited in claim 1 of the present invention. Lin also discloses that subsequent metal layers can be formed on top of the first layer by repeating the same steps as used for the first layer (Paragraph 0055), as recited in claim 1 of the present invention. It would be obvious for the inventor to divide the structure into imaginary layers prior to forming, as recited in step A of claim 1 of the present invention, because if the process is to be done in steps as taught by Lin and recited in the claims, it must be determined which portion will be done in each repetition. Since the layers are being placed on top of one another in the process, it would be obvious to divide the layers horizontally, as recited in claim 3 of the present invention. For each additional layer added, Lin teaches that a seed layer is deposited (Paragraph 0055), which is considered to be the middle seed layer by the examiner, as recited in claim 2 of the present invention. Lin lists a variety of metals that can be used for plating the first layer (Paragraph 0053). Since the various layers are being formed by the same process, it would have been obvious that a different type of metal can be used for each layer, as recited in claim 9 of the present invention. Lin states that chemical mechanical polishing (CMP) is used to remove the plated metal above the polymer layer (Paragraph 0060), as recited in claims 1 and 8 of the present invention.

Lin fails to disclose that the substrate is removed along with the photoresist and the seed layer.

Suzuki discloses a method for manufacturing a process mask comprising the steps of: forming a seed layer onto a substrate (Column 4, Line 51), forming a resist layer on top of the seed layer (Column 4, Line 62), patterning the resist layer (Column 4,

Line 66), plating a metal into the hollow pattern (Column 5, Line 25), and removing the resist layer, seed layer and etching the substrate (Column 5, Lines 29-36), as recited in claim 1 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have included in the process of Lin, a step of removing the substrate, as suggested by Suzuki because Suzuki teaches that it is common to remove at least part of the substrate when forming microstructures.

5. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin (U.S. Patent Application 2004/0166659) in view of Suzuki (U.S. Patent 6379871) as applied to claims 1-3, 8, and 9 above, and further in view of Ning (U.S. Patent 6979526).

The teachings of Lin and Suzuki have been discussed in paragraph 4 above. Lin also discloses that the seed layer can be chosen from a group of metals and is sputtered onto the substrate (paragraph 0053).

Lin and Suzuki fail to disclose that the substrate is made up of single crystal silicon.

Ning discloses a method of manufacturing a semiconductor memory device comprising depositing a seed layer onto a substrate (Column 4, Line 30), depositing a resist onto the seed layer (Column 4, Line 57), patterning the resist (Column 4, Line 59), plating a conductive material into the holes formed (Column 4, Line 64), and cleaning the resist from the wafer (Column 5, Line 12). Ning states that the substrate includes a workpiece, which can consist of single-crystal silicon (Column 3, Line 62), as recited in claim 4 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have used a wafer comprising single crystal silicon, as suggested by Ning, in the process of Lin and Suzuki because Ning teaches that this type of material is commonly used for substrates that are used in processes similar to what is recited in claim 1 of the present invention.

6. Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lin (U.S. Patent Application 2004/0166659) in view of Suzuki (U.S. Patent 6379871) as applied to claims 1-3, 8, and 9 above, and further in view of Ho ("Ultrathick SU-8 mold formation and removal, and its application to the fabrication of LIGA-like micromotors with embedded roots").

The teachings of Lin and Suzuki have been discussed in paragraph 4 above.

Lin and Suzuki fail to disclose that the photosensitive material has a large viscosity, that each layer is between 200 and 300 microns thick, and that the light source used in imaging is one of x-ray, laser or ultraviolet.

Ho discloses a study of the removal of an ultrathick photoresist layer comprising: placing a copper seed layer onto a wafer, depositing a 300 micron thick layer of photoresist onto the seed layer, patterning the layer, electrodepositing nickel into the mold, and removing the photoresist layer (page 132). The thick photoresist that is used is SU-8, which is considered a viscous polymer by the examiner, as recited in claim 5 of the present invention. Ho states that ultraviolet light is used for the patterning step (page 132), as recited in claim 6 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have modified the process of Lin and Suzuki by using a thick photoresist layer with a large viscosity, as suggested by Ho because Ho teaches that a thick photoresist can be used in processes similar to the one recited in claim 1 of the present invention and thick photoresists are excellent molding materials for electroplating. It also would have been obvious to have used ultraviolet light because Ho teaches that ultraviolet light is commonly used for patterning thick photoresists.

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lin (U.S. Patent Application 2004/0166659) in view of Suzuki (U.S. Patent 6379871) as applied to claims 1-3, 8, and 9 above, and further in view of Kim (U.S. Patent Application 2005/0001960).

The teachings of Lin and Suzuki have been discussed in paragraph 4 above.

Lin and Suzuki fail to disclose that the side plane of the photoresist pattern can be regulated to form an incline plane.

Kim discloses a method for producing a display device comprising a step of placing a passivation layer on top of electrodes formed on a semiconductor wafer (Paragraph 0062). Kim states that a photosensitive resin can be used as the passivation layer and that the light intensity of the exposure light can be controlled to change the inclination angle (Paragraph 0074), leading to an inclined plane, as recited in claim 7 of the present invention.

It would have been obvious to one of ordinary skill in this art, at the time of invention by applicant, to have added to the process of Lin and Suzuki, a step of

producing an inclination angle in the photoresist layer by changing light intensity, as suggested by Kim because Kim teaches that this technique forms different inclination angles, which produce different patterns.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Brittany Raymond whose telephone number is 571-272-6545. The examiner can normally be reached on Monday through Friday, 8:00 a.m. - 4:30 p.m. EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on 571-272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

blr

KATHLEEN DUDA
PRIMARY EXAMINER
GROUP 1100